the character of the work done in the experiment stations.

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SPECIAL ARTICLES

A DEVICE FOR PROJECTING A SMALL SPOT OF LIGHT SUITABLE FOR EXPLORING PHOTOSENSITIVE AREAS [1]

IN experimental work on light reactions the question of the precise location and extent of the photosensitive areas frequently presents itself. If the organism under observation happens to be small, or if minute sensitive elements are scattered in various parts of the integument, the problem has its difficulties. One of the obvious methods of attack is to explore the animal with a spot of light. To be of practical value for this sort of work the light spot must be small, clearly defined, and without halo, and it should be possible to direct it with the utmost ease and precision. Various devices have been employed for this purpose, none of which has proved entirely satisfactory. The use of a "pinhole" aperture does not give a sharply defined spot of light at a convenient working distance. An elaborate system of collecting and focusing lenses is expensive and is very likely to be cumbersome to handle. After trying various schemes, I found that by inserting a small tungsten bulb into a microscope in place of the ocular and projecting the rays through the objective, a spot of light could be produced which fulfilled the requirements admirably.[2]

The accompanying figure shows the details of the apparatus. A piece of brass tubing, *P*, is turned to fit into the draw-tube of the microscope in place of the ocular, a collar being left on it to prevent it from sliding in too far. Into the upper end of this tube is fitted a wooden plug, *X*, bored to take a small screw

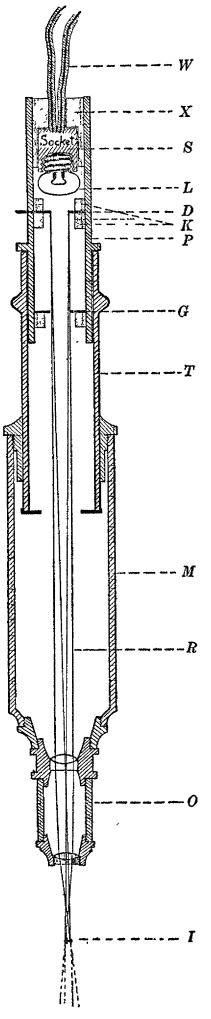

FIG. 1. A Device for Projecting a Small Spot of Light Suitable for Exploring Photosensitive Areas. *W*, wires from batteries to light; *X*, wooden plug fitted into the tube *P*, and bored to receive socket; *S*, screw socket for light; *L*, 2½-volt tungsten "flash-light" bulb; *D*, metal diaphragm with small circular aperture; *K*, cork collars holding diaphragm in place; *G*, diaphragm to cut out reflection from inside of tube, *P*; *P*, brass tube fitting into microscope in place of the ocular; *T*, draw-tube of microscope; *M*, barrel of microscope; *R*, construction lines indicating formation of the image, *I*; *O*, ocular; *I*, inverted and reduced image of aperture in diaphragm, *D*.

[1] From the Museum of Comparative Zoology, Harvard University, and the Anatomical Laboratory of the School of Medicine, Western Reserve University.

[2] The idea of utilizing the lenses of a microscope was suggested by Dr. Clark of the Physics department of Harvard University.

socket.[3] A two and one half volt tungsten bulb *L*, run by dry cell batteries furnishes the light. Immediately in front of the light a removable metal diaphragm, *D*, is inserted through a slot cut in the side of the tube. The aperture in the diaphragm has, for the sake of convenience and clearness in drawing the figure, been represented much larger than it is desirable to make it. A circular aperture of from one half a millimeter to a millimeter in diameter is a convenient size. If it is desirable to change the size of the light spot, a set of diaphragms of various sizes can easily be made. A second diaphragm, *G*, made of black cardboard and held in place by being cemented on to a cork collar should be inserted at the lower end of the tube carrying the light. This diaphragm serves to cut out any reflection from the inside of the tube. Its aperture should be about five times the diameter of that in the diaphragm, *D*. A low-power objective will be found most serviceable for projecting the light, as it brings it to focus at a distance from the microscope sufficient to allow the experimentor a clear field of vision in directing the spot. It has also the advantage of a greater depth of focus than a high power objective, making it much easier to keep the light spot in sharp focus on a moving animal. The adjustable *A** lenses are of about the right magnifying power and offer the additional advantage of allowing considerable variation in the size of the light spot without a change of diaphragms.

The spot of light produced by this apparatus is, of course, an image of the portion of tungsten filament not cut out by the diaphragm, *D*, reduced as many times as the objective magnifies, and projected at the focal point of the objective. By the use of a moderately high-powered lens the spot can be made as small as it is possible to follow with the naked eye, and absolutely without halo if the diaphragms are properly adjusted. It is at the same time very brilliant, and will be found to elicit a marked response from forms which are at all sensitive to stimulation by light. With it I have forced blow-fly larvæ to crawl in figure-of-eight loops only five or six centimeters in diameter.

In using the light to follow a moving animal, the barrel of the microscope is removed from the stand and held in the hand like a pencil. One can in this way direct the light with great ease and precision. I have found it so handled, very satisfactory both as a means of exploring for photosensitive areas and as a means of subjecting a limited region to continued stimulation while maintaining the surrounding tissues unstimulated.

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[3] Sockets of a size which fits readily into a microscope and which receive the standard sized flash-light bulbs can be obtained of any electrical supply house under the name of "telephone booth sockets."

THE AMERICAN PHYSIOLOGICAL SOCIETY

The 27th annual meeting was held in the physiological laboratories of the Washington University Medical School, St. Louis, Mo., December 28–31, 1914. Fifty-six of the societies' 208 members were present. Five scientific sessions were held, three of these being joint meetings with the other societies of the federation, at which the following papers and demonstrations were presented:

W. B. Cannon, C. A. Binger and R. Fitz, "Experimental Hyperthyroidism."

H. R. Basinger and A. L. Tatum, "Studies on Experimental Cretinism."

W. L. Gaines, "The Action of Pituitrin on the Mammary Gland."

George B. Roth, "The Several Factors Involved in the Standardization of Pituitary Extracts."

H. C. Dallwig, A. C. Kolls and A. S. Loevenhart, "The Relation between the Erythrocytes and the Hemoglobin to the Oxygen of the Respired Air."

J. A. E. Eyster and W. J. Meek, "The Path of Conduction for the Cardiac Impulse between the Sino-auricular and the Aurico-ventricular Nodes."

C. Brooks and A. B. Luckhardt, "An Experimental and Critical Study of Blood Pressure Methods."

F. C. Becht and M. McGuigan, "Mechanical Factors in the Flow of Cerebro-spinal Fluid."

Katherine R. Drinker and C. K. Drinker, "The Effect of Rapid and Progressive Hemorrhage upon the Factors of Coagulation."